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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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22850	7590	04/06/2004	EXAMINER	
OBLON, SPIVAK, MCCLELLAND, MAIER & NEUSTADT, P.C. 1940 DUKE STREET ALEXANDRIA, VA 22314			SAGAR, KRIPA	
			ART UNIT	PAPER NUMBER
			1756	

DATE MAILED: 04/06/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/069,951	Applicant(s) GAUCHER, PHILIPPE	
	Examiner Kripa Sagar	Art Unit 1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 December 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-22 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 24 April 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1- 6, 10-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over non-patent literature of Tohge and co-worker (Jl.Mat.Sc.,v10, (1999) p.273-277), hereinafter Tohge (1999), in view of US Pat. 5244691 to Valente et al.

The invention discloses a resin for forming oxide thin films, a process of forming oxide thin films from the resin and devices comprising such thin film oxides.

Claims 1-6 are directed towards a resin composition comprising alkoxides, chelating organic agents, acids and a photoinitiator.

Claims 10-17 recite the process steps of coating a resin comprising metal alkoxides, patterning the coated film by photolithographic steps, drying and sintering the patterned layer to form the oxide pattern.

Tohge (1999) teaches a method of forming photosensitive resins containing polymerized alkoxides. The resins are formed from the reaction of *metal n-butoxides* with chelating agents AcAc or benzylacetone (BzAc). The metal alkoxides include *Ti- and Zr- alkoxides*. Tohge (1999) does not add *acetic acid* and *Pb-carboxylate*, instead uses Pb-acetate. A *complex alkoxide Pb-Zr-Ti* (PZT) bearing resin is formed. The resin

is coated and patterned with *UV irradiation* (p.273-274). The substrates may be *glass* or *Si*. The patterning steps include *exposure* through a *mask* and *development* of unexposed areas. The patterned areas are sintered to form the oxides (fig.1). In the past, similar processes were used to pattern oxides such as *ZrO₂*, *TiO₂*, *Al₂O₃*, *SiO₂* from their *simple alkoxides* (p273). Tohge (1999) teaches the formation of *ferroelectric* thin films

Tohge (1999) does not teach the addition of an acid or HMTA (cl.1,6,10). Tohge (1999) does not teach the use of a heavy alcohol as a functional radical or solvent (cl.11).

Valente teaches the fabrication of ceramic films by spin coating a resin comprising the ceramic and sintering the film. A sol-gel process is used where the ceramic composition is formed from the *metal-alkoxide* and Pb-acetate. It teaches the use of *AcAcH* and *HMTA* to form the polymer. *Acetic acid* stabilizes the resin and may also be used as a *solvent* along with an alcohol such as methoxyethanol (3; 44-4;5). The film is dried and sintered. It may be noted that both Valente and Tohge (1999) teach formation of oxide thin films by sol-gel. Valente teaches that the process is complex and difficult to control (2;6-18).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Valente to form the oxide films of Tohge (1999) because Valente's compositions reduce the number of components(3;21-24), may be adapted to deposit a large number of diverse materials and provide tight controls on the rheology and deposition (3;25-37).

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3. Claims 7,8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tohge (1999) in view of Valente as applied to claim 1 above and further in view of US Pat. 4957945 to Cohn and further in view of US Pat. 6002031 to Duncombe et al.

The claims recite the use of propanoic acid and tetrafluoroacetic acid as solvents.

The teachings of Tohge (1999) and Valente have been discussed above. Tohge (1999) does not teach the use of acids. Valente teaches the use of acetic acid. They do not teach the use of the propanoic acid and tetrafluoroacetic acid.

Duncombe teaches the use of carboxylic acids in forming metal oxide films from a modified sol-gel process; this includes propanoic acid (4;31-33). Duncombe does not use tetrafluoroacetic acid.

Cohn teaches that fluorinated carboxylic acids in general and tetrafluoroacetic acid are well known solvents for polymers (5;67-6;3). Their low-boiling point is emphasized and the evaporation at low temperatures is noted (5;52-55).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute propanoic acid or tetrafluoroacetic acid for Valente's acetic acid as a solvent in Tohge's (1999) sol-gel process because carboxylic acids in general (Duncombe) and fluorinated carboxylic acids in particular (Cohn) are suitable solvents for polymers that may be used with a reasonable expectation of success in forming sol-gel polymers.

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4. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tohge(1999) in view of Valente as applied to claim 1 above, and further in view of US Pat. 5846686 to Kamisawa.

This claim recites the addition of a photoinitiator to the resin.

Kamisawa teaches the addition of a photoactive compound to a resin comprising alkoxides and used in forming ceramic films (9; 53-67).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to add a photoactive compound to Valente's resin used for forming a ceramic film as taught by Tohge(1999) because Kamisawa teaches that this increases the image resolution and facilitates development of the exposed film (11;53-12;14)

5. Claims 1-6, 10-17 are further rejected under 35 U.S.C. 103(a) as being unpatentable over US Pat. 5244691 to Valente et al. in view of the non-patent literature of Tohge and co-worker (Jl.Mat.Sc.,v10, (1999) p.273-277).

Valente teaches the fabrication of ceramic films by spin coating a resin comprising the ceramic and sintering the film. A sol-gel process is used where the ceramic composition is formed from the *metal-alkoxide* and Pb-acetate. It teaches the use of *AcAc* and *HMTA* to form the polymer. *Acetic acid* stabilizes the resin and may also be used as a *solvent* along with an alcohol such as methoxyethanol (3; 44-4;5). The viscosity may be adjusted by evaporating the solvent. Conventionally this evaporation is carried out by heating the mixture. The film is dried and sintered (3;58-66).

Valente does not teach photocuring the polymer.

Tohge (1999) teaches a method of forming photosensitive resins containing polymerized alkoxides. The resins are formed from the reaction of *metal n-butoxides* with chelating agents *AcAcH* or benzylacetone (*BzAcH*). The metal alkoxides include *Ti- and Zr- alkoxides*. A *complex alkoxide Pb-Zr-Ti (PZT)* bearing resin is formed. The resin is coated and patterned with *UV irradiation* (p.273-274). The substrates may be *glass* or *Si*. The patterning steps include *exposure* through a *mask* and *development* of unexposed areas. The patterned areas are sintered to form the oxides (fig.1). In the past, similar processes were used to pattern oxides such as *ZrO₂, TiO₂, Al₂O₃, SiO₂* from their *simple alkoxides* (p273). Tohge(1999) teaches the formation of *ferroelectric* thin films using the process.

It may be noted that both Valente and Tohge (1999) teach forming ceramic films using the sol-gel process. One of ordinary skill in the art at the time the invention was made would have been motivated to use UV radiation to cure or pattern the gelled film as taught by Tohge (1999) in Valente's process because Tohge (1999) teaches that this direct fine-patterning process facilitates fabrication of optical and electronic devices Tohge (1999 : p.273; # 1).

6. Claim 1 is further rejected under 35 U.S.C. 103(a) as being unpatentable over US Pat.5494700 to Anderson et al. in view of US Pat. 5944866 to Chen et al and further in view of US Pat. 5100764 to Paulson et al.

Anderson teaches most of the elements of claim 1 (Fig.1) including the metal alkoxides and solvents (5;13-34), acid addition (5;53-64), and heating the mixture (6;12-23) to form a polymeric pre-cursor.

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Anderson does not teach use of HMTA or UV radiation.

Chen teaches the use of HMTA as a stabilizer and gellation agent (3;40-59) in a process analogous to Anderson's.

Chen does not teach the use of UV radiation.

Paulson teaches the inclusion of a photoactive compound in the precursor polymer used in a process for forming glass and ceramic films, analogous to Anderson's and Chen's. UV irradiation is used to pattern the films (3;7-23).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to add HMTA, as taught by Chen to Anderson's solutions and UV expose the resulting resin film as taught by Paulson because Chen teaches that HMTA serves multiple functions during the process (3;40-59) and thereby reduces the amount of the agents required (3;1-8) while Paulson teaches that UV-patterning before calcining makes the films amenable for use in the electronic device fabrication (1; 41-66).

7. Claim 18,20 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Valente.

Valente teaches fabricating capacitors and ferro-electric memories (4-49-68). The instant claim does not detail the structure of the capacitor; any capacitor or memory formed by any process would function as well as the instant claimed devices.

8. Claim 19 is rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Mori.

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Mori teaches that it is known in prior art to use complex perovskitic oxides as piezo-electric materials (1;14-16). Any piezo-electric device would function as well as the instant-claimed device.

9. Claims 21-22 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over US Pat.4541855 to Scherer.

Scherer teaches a method of forming a glass or ceramic product (abstract). The glass or ceramic product would have the structure and function of the instant claimed glass or ceramic.

Response to Arguments

10. Applicant's request for reconsideration filed 12/7/03 and the arguments have been reviewed. Examiner maintains the rejection and responds to the arguments below.

Applicant's invention is in a well-developed field as admitted in the instant specification (p.1; lines1-35). Applicant's stated improvement to the process comprises a resin formed by heating a mixture of metal alkoxides with AcAc, HMTA and an acid. Applicant alleges (p.1;l.35 – p.2;l.13) that the resultant resin provides greater homogeneity (stability) and better rheological control. These are also taught by Valente, as shown above.

(A) Tohge in view of Valente and further in view of other references

Applicant argues that (1) Tohge teaches away from using AcAc. (2) It teaches away from adding an acid. (3) There is no motivation to combine Tohge with any of the other references.

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(1) Applicant is reminded that claims 1-9 recite a resin; claims 10-17 recite a process of using the resin. No claims recite the process of making the resin. Due weight is given to the steps of making the resin, in the light of the specification. However the claims 1-9 are drawn to a resin. Applicant has not specified any property of the resin made by the process claimed nor shown any unique or unexpected results from the process.

The resin made by Tohge's prior-art process with AcAc has been successfully used as asserted by Tohge. Applicant has not shown how the instant resin differs from Tohge's using AcAc.

Applicant's assertion that Tohge teaches away from substituting BzAc with AcAc is not convincing. Tohge teaches successful use of AcAc in preparing a resin. The improvement lies in substituting BzAc for AcAc in order to specifically derive the benefits of higher wavelength radiation. Even the most rudimentary knowledge of the process would enable one to recognize the equivalence of the two homologs and the similarity of their functions in the resin. In view of the prior experience of Tohge in successfully forming and using the resin, the substitution would have been obvious. There is no assertion in Tohge and Applicant cannot show any statement that AcAc would not work in making the resin. As shown below, the use of the homolog BzAc, favors the use of a high pressure Hg-vapor lamp. However there is no assertion that it would fail with AcAc. There is no teaching away from the use of AcAc.

(2) Applicant's argument that one of ordinary skill in the art would not be motivated to add an acid in making the resin is based on a gross misunderstanding of the process. The following points will clarify the use of the acid in preparing the resin and the

equivalence of AcAc and BzAc -- specifically with reference to the arguments 1,2 above.

Applicant's attention is drawn to the basic steps in the current art. They comprise:
* preparation of a resin comprising a metal alkoxide, a chelating agent such as BzAc or AcAc, a photoinitiator and a hydrolyzing agent such as an acid ; * coating the resin on a substrate and patterning it with radiation; *developing the pattern to produce features.

The radiation used is suited to the absorbance band of the chelating agent – BzAc absorbs at a longer wavelength than AcAc (Tohge: p.273; col.2 – p.274.col.1;line1.) Therefore longer wavelength light can be used to pattern a resin with BzAc whereas AcAc requires radiation in the MUV-range. The longer wavelength exposure allows the use of less expensive and more commonly used Hg-vapor lamp in contrast to the UV-radiation sources.

The chelating rings are dissociated by the UV radiation (due to absorbance) and their solubility changes in the exposed area compared with the unexposed area. This permits the "development" of the pattern by removing the exposed (or unexposed) areas with a solvent. The preferred solvent *is acidic with a pH of 1.7* and includes HNO₃. The relevant section is reproduced below.

"The UV-irradiation also caused a change in solubility of the PZT gel films in alcohols or *acidic aqueous solutions*. The gel films became insoluble in these solutions after the irradiation, while they were soluble before the irradiation, which is an implication of some structural changes in the gel films. This change in solubility of the gel films with UV-irradiation was applied to the fine- patterning process; the gel film irradiated with UV-light through a mask was leached in an appropriate solution, followed by the heat-treatment. One of the requirements for leaching solutions to produce fine patterns is to give good contrast in solubility of the gel films between irradiated and unirradiated parts. In this sense, MeOH/H₂O mixed solutions and HNO₃ aqueous solutions with pH of around 1.7 were found to be

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suitable as a leachant, though the latter was much better than the former to form fine patterns on a micrometer scale. Fig. 5 shows an optical micrograph of the patterned PZT gel film on a Si wafer after heat-treatment at 450 deg.C. The dark areas show the PZT films and bright areas the substrate; the pattern obtained is a negative one of the mask used. The thickness of the patterned PZT film is about 0.3 μm and the smallest pattern in the figure is approximately 5 μm . It is expected that much finer patterns will be obtainable when a much finer mask and collimated UV-light are used (11)." (Tohge:p.275;sec.3.2).

The passage cited by Applicant (p276; sec.4.) refers to the solubility in acid developer after irradiation and has no relevance to the addition of acid in preparing the resin. The argument that one would not add an acid to form the resin is based on misinterpretation of a selected passage and is contrary to the science; Applicant should have been aware of the role of the acid in the resin-forming mixture.

(3) The argument that there is no motivation to combine Valente or the other references with Tohge is based on Applicant's erroneous understanding of the process and Tohge's teaching. Applicant's understanding that the chelating agent would precipitate out when irradiated in an acidic environment is shown to be fundamentally flawed. This has been clarified above and thus the motivation as stated in the rejection above is persuasive. The combinations teach all the elements of the claims and Applicant has not provided any showing how the resins would differ from that of the instant invention.

(B) Valente in view of Tohge

Examiner has rejected claims 1-6,10-17 over Valente in view of Tohge. Valente teaches most of the elements of the claims and Tohge's teaching provides a photocuring step. The motivation for combining has been given above.

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Applicant has not provided any arguments against Valente in view of Tohge and appears to concede that the combination makes a prima facie case.

(C) Applicant has argued against the '700 reference, the '866 reference, and the '764 reference (p.7) . Examiner agrees that the references do not teach the use of AcAc.

The argument of hindsight reasoning is refuted by the volume of references available in the art. As stated above, this is a well-developed art and the process has been routinely used in fabrication of diverse articles since a very long time. Applicant admits the history of prior-art (instant specification; p.1:lines.1-35).

(D) With reference to the rejection of claims 18,20 (over Valente), 19 (over Mori) and 21,22 (over Scherer) Applicant is reminded that each of the claims recites a product.

No description or specification of the product is provided – there being no unique structure or special property associated with the product. Although due weight is given to the process by which the product is made, the product is not patentable because it lacks any novel or unobvious limitations.

(E) Applicant has argued extensively on the *method of making a resin*. Examiner notes that there are no claims directed to the method of making the resin. Further, there is no data in the specification to suggest that the resin made by well-known processes would have any unexpected or unique property. Assertions of greater stability and better rheological control are not substantiated by any comparative data.

Conclusion

Applicant is encouraged to contact the Examiner for clarification of any of the points in the response to the arguments.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

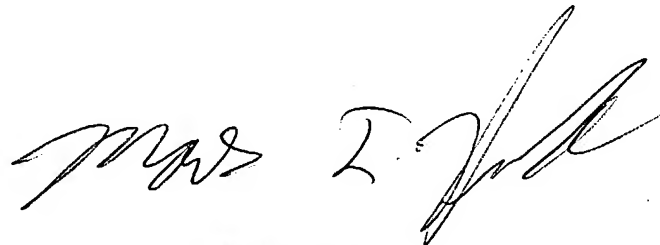
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kripa Sagar whose telephone number is 571-272-1392. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark F Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

MH/ks

A handwritten signature in black ink, appearing to read "Mark F. Huff", is written over a faint, larger signature.

MARK F. HUFF
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700